Space Weather Technical Forecast

Issued on Thursday, 13 October 2022 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares. Active electron Fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with C-class flares observed from AR3112 (Fai/Beta-Gamma) peaking C8.8 at 12/1418 UTC, and a long period C3.7 flare was observed lasting around 5.5 hours from this region (12/0505-1035 UTC). AR3112 has shown some simplification as it approaches the western limb, with visible spots appearing to shrink in size, most notably the trailer. AR3116 (Hax/alpha) to the north of this region, remains a simple unipolar region. C-flaring was also observed from AR3119 Dsi/Beta, also in the northwest quadrant, but closer to the centre disc. However, AR3119 remains a smaller and magnetically simpler region than AR3112. The C8.8 flare generated a weak CME, which will be analysed once imagery becomes available, but is likely to be off the Earth-Sun line. No other CME's were observed, however there are also a number of filaments that will need to be monitored for any potential eruption.

Solar Wind / Geomagnetic Activity: The solar wind speed, as observed at L1, persisted at 350-400 km/s as Earth continues within the ambient slow wind. Density remained below average. The total IMF strength, Bt, has been weak at below 5nT, with the north-south component, Bz predominately, but weakly negative. The phi angle was initially negative (towards the Sun), but exhibited a solar sector boundary crossing (SSB) around 12/1046 UTC, becoming mostly positive (away from the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, has been at background levels. High energy electron flux (greater than 2MeV) has persisted at high levels, peaking at 6216 pfu at 12/1420UTC. The associated 24-hour fluence has been above the Active (1e8 integrated pfu) threshold throughout, with a gradually rising trend. The 12/0000 UTC observation was 2.62e8 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Low to Moderate with an ongoing chance of M-flares, primarily from AR3112 but potentially from AR3119 or other smaller regions on the disc.

Solar Wind / Geomagnetic Activity: There is a CME that is likely to miss Earth tomorrow (14th), but has a small chance of giving a peripheral influence as it passes. Otherwise Earth will likely see background winds persisting through much of the period, before the arrival of the fast wind of CH32/- late on tomorrow or more likely arriving during day 3 (15th). Geomagnetic activity will be mostly Quiet with a chance of isolated Unsettled (Kp 1-3) intervals, perhaps increasing to Active (Kp 4) with any fast wind arrival.

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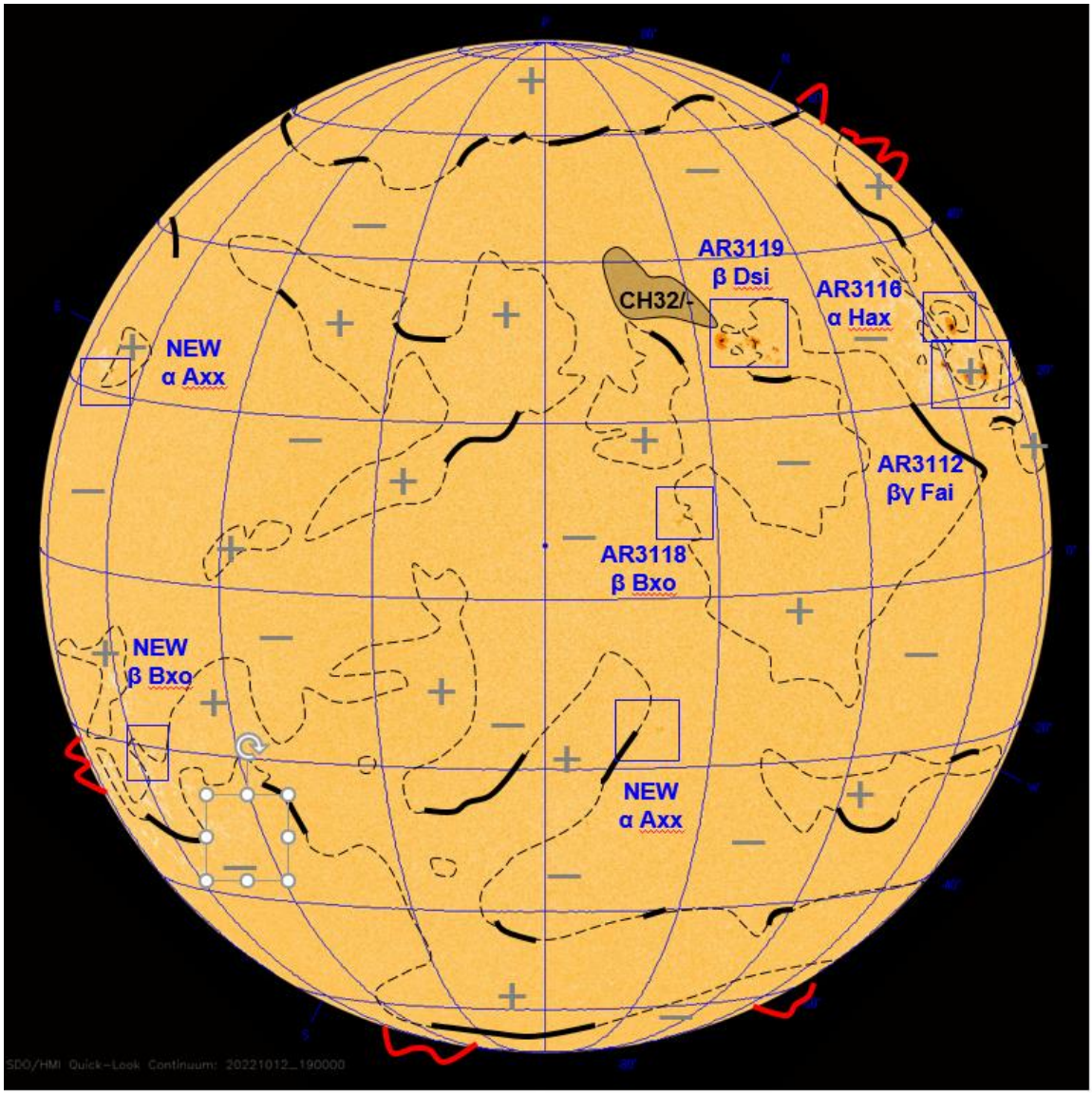
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at background, but with a daily slight chance of rising in response to any large flares from AR3112. The high energy electron flux (greater than 2 MeV) is likely to persist at predominately High levels, only falling in response to any fast wind arrival late tomorrow or during day 3 (15th). The associated electron fluence is forecast to persist at Active levels, albeit with decreasing confidence.

Figure 1. Solar Analysis Valid 12/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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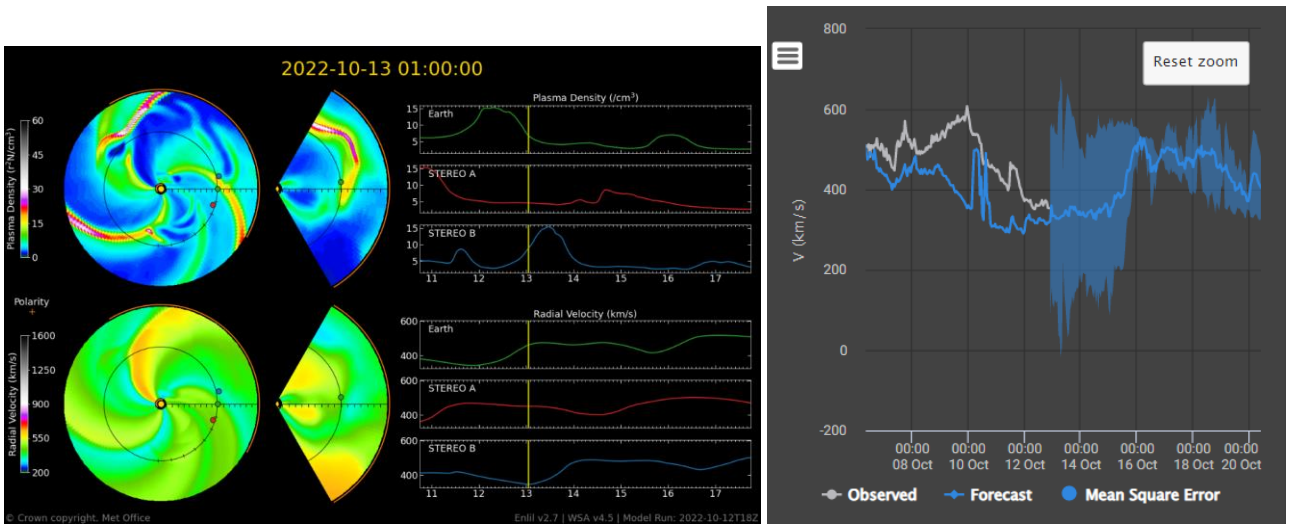
Geomagnetic Storms:

There is a weak CME, from a filament eruption on the 9th, which may have peripheral influences on the geomagnetic forecast either late tomorrow or during day 3 (15th), but is more likely to miss Earth. Further CMEs from the M-flares of AR3912 on previous days have also been assessed as missing, and the flare from the C8.8 flare yesterday has not be analysed but is likely to not be Earth directed.
Solar winds are currently at background levels, with Earth embedded with an ambient slow wind environment. The next coronal hole fast wind enhancement is anticipated to be from CH32/- late tomorrow (14th) or during day 3 (15th). This feature was larger in western extent on the previous rotation, and following persistence would be expected to arrive during day 3 (15th). Therefore the weak enhancement in the solar wind speed shown today in Enlil is considered to be too early for the HSS arrival.
Mainly Quiet geomagnetic activity is expected with isolated Unsettled intervals. There is a chance of Active intervals late tomorrow (14th) or more likely day 3 (15th) from any fast wind arrival. There is a very slight chance of G1/Minor Storms, mainly if the HSS arrival combines with an weak influence from the passing CME.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Met Office Enlil model (left) and solar wind persistence model (right)



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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

There are four numbered regions on the disc, plus various new small and weak yet to be numbered regions. AR3112 remains as the source of the majority of the activity over the last few days, and persists as a Fai/beta-gamma despite recent very slight decay in area. The region is approaching the western limb and therefore is becoming harder to view, and will rotate to the far side by the end of the forecast period. The only other region of note is AR3119, Dai/beta, although this remains a relatively simple region.
No significant regions are expected to rotate onto the visible disc during the forecast period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	20	10
Very Active	R3 to R5 X Class	No	2	2	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) as observed by GOES-16 is currently at background levels. Despite recent flaring over the last couple of days from AR3112, which is in a geoeffective location for proton storming, no observable high energy proton flux has been observed. With this sunspot now appearing to have simplified slightly, and no other significant regions, there is a reduced chance of notable flares, and subsequently only a very slight chance of approaching, or exceeding, the S1 threshold.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

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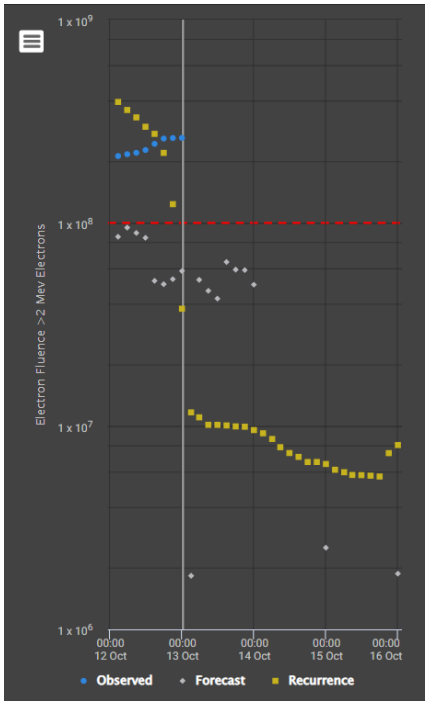
High energy electron flux (greater than 2MeV) as observed by GOES16 is currently High (above 1000 pfu). With no significant solar wind enhancement expected until the arrival of the fast winds of CH32/- late tomorrow (14th) or during day 3 (15th) then these levels are expected to persist for much of the period, albeit with a chance of the peak flux declining. If any geomagnetic activity occurs as a result of the HSS arrival, or potential weak influence of a passing CME, then flux levels are likely to drop out to Background to Moderate.
The associated 24 hour fluence is forecast to persist at Active (above 1e8 integrated pfu) throughout the period, only significantly falling in response to any flux drop out later in the period.
The current REFM forecast is currently producing poor guidance, and so should be disregarded.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	Yes	100	100	90	80
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: Met Office REFM model which currently producing poor guidance.



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